Dust Mitigation on Mars Using an Electrostatic Precipitator

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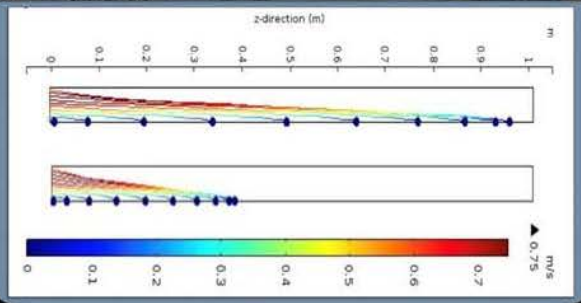
Introduction

The Martian atmosphere contains large amounts of dust, which are lofted by dust devils and dust storms. Some of this dust, particles on the order of 2-4 µm, never settle and are constantly present in the atmosphere. Therefore, in order to utilize the planet's atmosphere for production of consumables, like oxygen and methane, this dust must be removed before the commodity production can begin. The electrostatic precipitator is currently being studied at Kennedy Space Center as a realistic option for removing this dust.

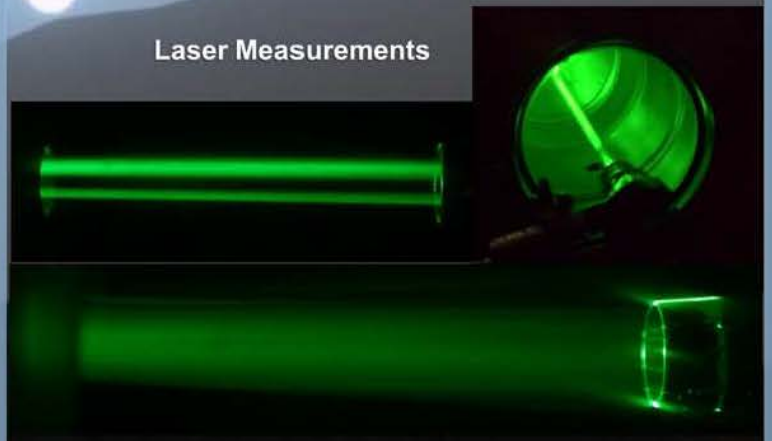
Electrostatic Precipitator

The electrostatic precipitator used for this project consists of a cylindrical tube of ~1 m in length, with a thin wire electrode running the length of the tube. An electrostatic potential difference is applied to the center electrode and the outer wall of the cylinder, so that a corona forms, which charges the dust particles as they pass through it. The charged particles are then forced to the outer wall of the precipitator by the strong electric field between the wall and the electrode, where they are collected. My role in the project was to figure out how to obtain a Martian atmosphere-like dust flow inside of the precipitator and how to analyze this dust flow before and after precipitation.



Fine Particle Analyzer (FPA)

Laser Measurements



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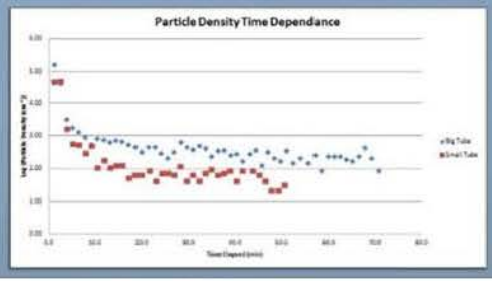
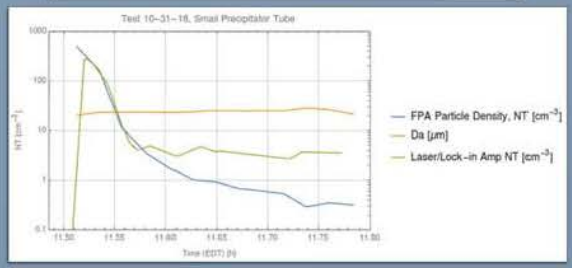
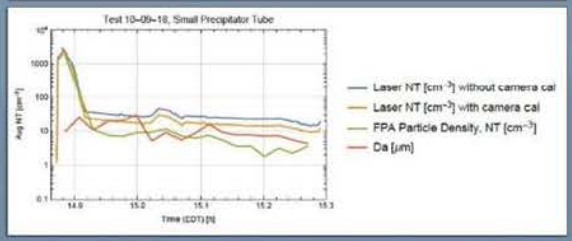
Special thanks to: John Lane from LASSO-SURA and Jerry Wang, Michael Johansen, Carlos Calle, and Jay Phillips from UB-R2

Dust Flow Analysis

The team tested various amounts and particle sizes of JSC-Mars for use in the electrostatic precipitator. The flow of the desired particle sizes were achieved by using a mixture of ~10% by mass JSC-Mars of particles size <25 µm and ~90% by mass >95 µm. The time length of particle flow period can be extended or reduced by increasing or decreasing the total mass of JSC-Mars added to the fluidized dust bed, respectively. The laser measurements that resulted in the best results for comparison to the FPA measurements consisted of side scatter measurements with a Canon camera and a zoom lens.







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